Finding Area

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1 Question

If an equlateral triangle, having centroid at the origin, has a side along the line (1 1)x = 2,then find the area of this triangle.

2 solution

Given line equation of one side is

$$\begin{bmatrix}1 & 1\end{bmatrix} X = 2$$

and centroid is at origin O(0,0).
Since it is an equilateral triangle, the perpendicular distance between centroid and any side = $\frac{a}{2\sqrt{3}}$

where a is side length of triangle

The perpendicular distance between point (x_1,y_1) and straight line ax+by+c=0 is given by $\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}$
let d be the perpendicular distance

$$\text{d} = \frac{|1(0)+1(0)-2|}{\sqrt{1^2+1^2}}$$

$$\text{d} = \frac{2}{\sqrt{2}}$$

$$\text{d} = \sqrt{2}$$

From above we know that

$$\text{d}=\frac{a}{2\sqrt{3}}$$

$$a=2d\sqrt{3}$$

$$\text{The area of equilateral is } \frac{\sqrt{3}a^2}{4}$$

$$\text{Area} = 3\sqrt{3}d^2$$

$$\text{Area} = 3\sqrt{3}(\sqrt{2})^2$$

$$\text{Area} = 6\sqrt{3}$$

The figure of perpendicular from centroid to side of triangle

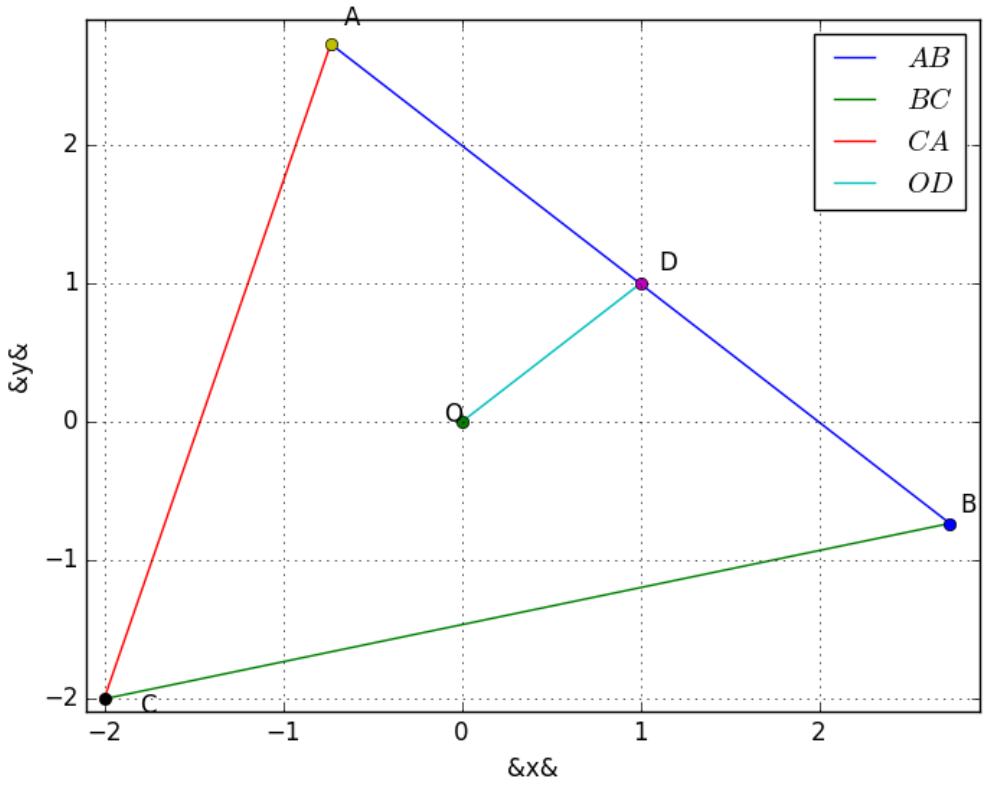

Figure 1: perpendicular from centroid